BRANCHIAL MODIFICATION OF URINE AND OSMOREGULATION IN THE LAND CRAB, *BIRGUS LATRO* (ANOMURA: COENOBITIDAE)

The regulatory capacity of the excretory system of *Birgus latro* was examined in relation to osmoregulation in the terrestrial environment. On land the availability of salts and water in the diet and drinking water, and evaporative water loss, may vary widely. Successful land animals, e.g. insects, mammals, generally exhibit versatile control of urinary fluid output and salt concentration.

Previous measurements on *Birgus* (Gross, 1955) indicated that the urine, like that of other anomuran and brachyuran crabs, was isosmotic to the haemolymph. Harris and Kormanick (1981) inferred that urine filtration continued even during desiccation. These observations suggested that *Birgus* may have a poor capacity for excretory regulation, the urine representing a potentially large drain on body water and ions. Gross (1955) postulated that *Birgus* osmoregulates behaviourally by choosing between drinking water sources of different salinities. However, on Christmas Island, Indian Ocean, *B. latro* range up to several kilometres from the coast, and sea water is clearly unavailable to most individuals as a source of ions and water. In rain forest, crabs drink from temporary rainwater puddles.

Crabs were maintained on fresh water and on saline (300, 600,1000 mosmol/kg sea water) drinking regimens. The final urine, released from the antennal organs, was confirmed to be isosmotic with haemolymph. However, *Birgus* exhibits branchial reprocessing of the urine, as postulated for some brachyuran terrestrial crabs (Wolcott and Wolcott, 1985, 1988). The final excretory product ('P', Wolcott and Wolcott, 1988) differs greatly in composition and flow rate from the filtered primary urine and the final urine.

The urinary apertures are directed posteriorly and open underneath the branchiostegites. Hydrophilic hairs on the scaphognathites, branchiostegites and mouthparts convey urine to the gills and to the mouth. The volume of the urine is reduced by reingestion and its composition is modified by branchial ion transport processes. Switching between fresh water and saline regimens caused rapid compensatory adjustments to drinking rate, primary urine formation (51Cr-EDTA clearance), branchial ion reabsorption and P production. The volume and concentration of the released P could be varied widely, e.g. [Na] and [Cl] <10 to >600 mmol/L. The combination of reingestion and branchial ion transport provides *Birgus* with a versatile, ion and water conserving, excretory system, well-suited to its terrestrial habitat. Animals drinking freshwater effectively reabsorbed more than 90% of the filtered water, and more than 99% of the filtered sodium and chloride. In animals drinking sea water, reabsorption of each of these components decreased to about 70%. This regulatory role for the gills is supported by strong uptake of Na and Cl from experimentally recirculated salines and by the demonstration of high activities of Na + K activated ATPases in gill extracts.

Literature Cited

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